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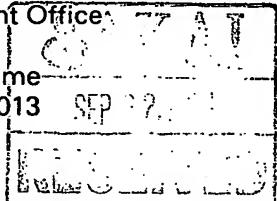
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To:

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Applicant's or agent's file reference 546738WO05	IMPORTANT NOTIFICATION
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Applicant MITSUBISHI DENKI KABUSHIKI KAISHA et al	

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<u>Priority date</u>	<u>Priority application No.</u>	<u>Country or regional Office or PCT receiving Office</u>	<u>Date of receipt of priority document</u>
04 July 2003 (04.07.2003)	2003-192156	JP	19 Augu 2004 (19.08.2004)

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AMENDMENT (Translation)
(Amendment under Art. 11)

To: Commissioner, Patent Office

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1. Identification of the International Application
PCT/JP2004/009595.

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4. Object of Amendment Specification and Claim

5. Contents of Amendment

25 (1) "An automatic programming device according to one aspect of the present invention ... can be provided." in the specification, pp.3, lines 7 to 20 is amended as follows:

An automatic programming device according to one aspect of the present invention creates a machining program 30 for machining a machining region determined by using a work model and a product model with an NC device, with respect to a two-spindle machine tool having a main spindle and a sub-spindle, and a one-spindle machine tool having only the

main spindle as a control object. The automatic programming device includes a first machining-program creating unit that creates a machining program for the two-spindle machine tool, including a machining program for the 5 first process to be performed by using the main spindle and a machining program for the second process to be performed by using the sub-spindle; a second machining-program creating unit that creates a machining program for the one-spindle machine tool, including a machining program for the 10 first and the second processes to be performed by using the main spindle; a selecting unit that determines whether the control object is the two-spindle machine tool or the one-spindle machine tool, and actuates either one of the first and the second machining-program creating units according 15 to the determination result. The first machining-program creating unit executes the process development processing for breaking down machining in the first process to be performed by using the main spindle and machining in the second process to be performed by using the sub-spindle 20 into a unit of machining unit, for which continuous machining is performed with the same spindle and the same tool, collectively for the machining for the first and the second processes. The second machining-program creating unit executes the process development processing for 25 breaking down machining of the first and the second processes to be performed by using the main spindle into a unit of machining unit, separately for the machining in the first process and the second process.

According to this invention, it is determined whether 30 the control object is the two-spindle machine tool or the one-spindle machine tool, and either one of the automatic programming device for the one-spindle machine tool and the automatic programming device for the two-spindle machine

tool is actuated according to the determination result. As a result, the automatic programming device applicable to both of the two-spindle machine tool having the main spindle and the sub-spindle, and the one-spindle machine 5 tool having only the main spindle can be provided.

Furthermore, when it is determined that the machine tool to be controlled has the sub-spindle, the process development processing is executed collectively for the machining in the first process and the second process. As a result, the 10 program for the first and the second processes can be created as one continuous program, thereby saving time and energy for programming, and enabling efficient programming."

15 (2) "a first machining-program creating unit ... for the one-spindle machine tool;" in claim 1, lines 5 to 7 is amended as follows:

20 "a first machining-program creating unit that creates a machining program for the two-spindle machine tool, including a machining program for the first process to be performed by using the main spindle and a machining program for the second process to be performed by using the sub-spindle;

25 a second machining-program creating unit that creates a machining program for the one-spindle machine tool, including a machining program for the first and the second processes to be performed by using the main spindle;", and "An automatic programming device ..." in claim 1, line 12 and the above lines is amended as follows:

30 "wherein the first machining-program creating unit executes the process development processing for breaking down machining in the first process to be performed by using the main spindle and machining in the second process

to be performed by using the sub-spindle into a unit of machining unit, for which continuous machining is performed with the same spindle and the same tool, collectively for the machining in the first and the second processes, and

5 the second machining-program creating unit executes the process development processing for breaking down machining of the first and the second processes to be performed by using the main spindle into a unit of machining unit, separately for the machining in the first 10 process and the second process."

(3) Claim 2 is deleted.

(4) "The automatic programming device according to claim 2" in claim 3 is amended as, "The automatic programming device according to claim 1".

15 (5) "The automatic programming device according to claim 2" in claim 4 is amended as, "The automatic programming device according to claim 1".

6. Attached documents

20 (1) Pages 3 and 3/1 of the specification
(2) Pages 44, 44/1, 45 and 45/1 of Claims

Laid-Open No. H2-62603), it is determined whether respective processing sites specified by an operator to be machined by any one of a first process performed by using the main spindle and a second process performed by using 5 the sub-spindle can be machined only by the first process or the second process, or can be machined only through the first and the second processes, and machining is executed based on the determination result.

In the Patent document 3, however, it is only 10 disclosed that the respective processing sites can be machined only by the first process or the second process, or can be machined only through the first and the second processes. Hence, automatic programming applicable to both of the one-spindle machine tool and the two-spindle machine 15 tool cannot be executed according to the Patent document 5.

The present invention has been achieved in order to solve the above problems, and it is therefore an object of the invention to provide an automatic programming method and device that can be applied to any of the two-spindle 20 machine tool having the main spindle and the sub-spindle, and the one-spindle machine tool having only the main spindle.

DISCLOSURE OF INVENTION

25 An automatic programming device according to one aspect of the present invention creates a machining program for machining a machining region determined by using a work model and a product model with an NC device, with respect to a two-spindle machine tool having a main spindle and a 30 sub-spindle, and a one-spindle machine tool having only the main spindle as a control object. The automatic programming device includes a first machining-program creating unit that creates a machining program for the two-

spindle machine tool, including a machining program for the first process to be performed by using the main spindle and a machining program for the second process to be performed by using the sub-spindle; a second machining-program creating unit that creates a machining program for the one-spindle machine tool, including a machining program for the first and the second processes to be performed by using the main spindle; a selecting unit that determines whether the control object is the two-spindle machine tool or the one-spindle machine tool, and actuates either one of the first and the second machining-program creating units according to the determination result. The first machining-program creating unit executes the process development processing for breaking down machining in the first process to be performed by using the main spindle and machining in the second process to be performed by using the sub-spindle into a unit of machining unit, for which continuous machining is performed with the same spindle and the same tool, collectively for the machining for the first and the second processes. The second machining-program creating unit executes the process development processing for breaking down machining of the first and the second processes to be performed by using the main spindle into a unit of machining unit, separately for the machining in the first process and the second process.

According to the present invention, it is determined whether the machine tool to be controlled is the two-spindle machine tool or the one-spindle machine tool, and based on the determination, the automatic programming device for the one-spindle machine tool or the automatic programming device for the two-spindle machine tool is actuated. As a result, the automatic programming device applicable to both of the two-spindle machine tool having

the main spindle and the sub-spindle, and the one-spindle machine tool having only the main spindle can be provided.

BRIEF DESCRIPTION OF DRAWINGS

5 Fig. 1 is a block diagram of a configuration of an automatic programming device; Fig. 2 is a block diagram of an NC unit having the automatic programming device built therein; Fig. 3 is a flowchart of an operation procedure of an automatic programming device according to a first
10 embodiment of the present invention; Fig. 4 is a schematic for illustrating an example of a menu selection main screen; Fig. 5 is a schematic for illustrating an example of an extension menu of the menu selection main screen; Fig. 6 is a schematic for illustrating an example of a product
15 shape-reading screen; Fig. 7 is a schematic for illustrating an example of a work shape-setting screen, Fig. 8 is a table of an example of stored data in work-type database; Fig. 9 is a schematic for illustrating a relation

CLAIMS

1. (Amended) An automatic programming device that creates a machining program for machining a machining region determined by using a work model and a product model with 5 an NC device, with respect to a two-spindle machine tool having a main spindle and a sub-spindle, and a one-spindle machine tool having only the main spindle as a control object, comprising:

10 a first machining-program creating unit that creates a machining program for the two-spindle machine tool, including a machining program for the first process to be performed by using the main spindle and a machining program for the second process to be performed by using the sub-spindle;

15 a second machining-program creating unit that creates a machining program for the one-spindle machine tool, including a machining program for the first and the second processes to be performed by using the main spindle;

20 a selecting unit that determines whether the control object is the two-spindle machine tool or the one-spindle machine tool, and actuates either one of the first and the second machining-program creating units according to the determination result,

25 wherein the first machining-program creating unit executes the process development processing for breaking down machining in the first process to be performed by using the main spindle and machining in the second process to be performed by using the sub-spindle into a unit of machining unit, for which continuous machining is performed 30 with the same spindle and the same tool, collectively for the machining for the first and the second processes, and the second machining-program creating unit executes the process development processing for breaking down

machining of the first and the second processes to be performed by using the main spindle into a unit of machining unit, separately for the machining in the first process and the second process.

5

2. (Deleted)

3. (Amended) The automatic programming device according to claim 1, wherein the first machining-program creating 10 unit comprises:

a product-model setting unit that selectively sets a product model;

a work-model setting unit that selectively sets a work model;

15 a jig setting unit that sets a jig for each of the first and the second processes;

a registration setting unit that executes registration processing between the product model and the work model in the first and the second processes;

20 a process-division setting unit that determines a process dividing position between the first process and the second process;

a process-development processing unit that breaks down machining in the first process and machining in the second 25 process into a unit of machining unit; and

a program-development processing unit that creates a machining program for each of the first and the second processes based on the information relating to the process-developed machining units, tool information, and cutting 30 conditions.

4. (Amended) The automatic programming device according to claim 1, wherein the second machining-program creating

unit comprises:

a product-model setting unit that selectively sets a product model;

5 a work-model setting unit that selectively sets a work model;

a jig setting unit that sets a jig for each of the first and the second processes;

10 a registration setting unit that executes registration processing between the product model and the work model in the first and the second processes;

a process-division setting unit that determines a process dividing position between the first process and the second process;

15 a work-model reversing unit that reverses the direction of the work model by 180 degrees;

a process-development processing unit that breaks down machining in the first process and machining in the second process into a unit of machining unit; and

20 a program-development processing unit that creates a machining program for each of the first and the second processes based on the information relating to the process-developed machining units, tool information, and cutting conditions.

25 5. An automatic programming method for creating a machining program for machining a machining region determined by using a work model and a product model with an NC device, ...